Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/377
USSR
February 1964
Original: RUSSIAN

Confidential until official release during Conference

Abstract

PHYSICS OF REACTOR SHIELDING

O.I.Leipunsky et al.

The rapid progress in the utilization of nuclear energy gave rise to a science of nuclear radiation shielding one of the branches of which is the physics of shielding. The physics of shielding covers the investigations of radiation fields, migration of radioisotopes, physical standartization of the biological effects of radiation.

The knowledge of radiation fields in the matter is of special importance.

The development of the research techniques requires new experimental facilities and new theoretical approaches. The paper mentions new equipment for carrying out research in the field of shielding.

Many problems connected with the gamma-ray and neutron fields have been solved in the recent years. A prominent place is held in these investigations by a method whereby the field of an elementary radiation source is investigated first and then the field of a real source is treated as a superposition of the fields from the elementary sources. For a long time an elementary source was taken to be a point isotropic source.

However, a point monodirectional source (narrow ray) is a more elementary source which can be used to form all sources treated before (isotropic point, isotropic plane and anisotropic sources). The paper presents the results of the experimental study of the fields from monodirectional point sources in various media and the empiric formulae which describe the results of the experiments. A useful contribution to the calculation of the field of a monodirectional point source can be made by the use of adjoint functions for solving the kinetic equation of the transfer of γ -quanta.

Translation provided by courtesy of the submitting Government

Calculation of the shielding is connected with the evaluation of the biological effect of penetrating radiation. Hence the necessity for more accuracy in determining the spectrum of neutrons coming through the shelding and for evaluation of the radiation dose from intermediate-energy neutrons. A "dose storage factor" was introduced to describe the doses. This "dose storage factor" was calculated for various compositions and various arrangement of the reactor shielding layers.

An extensive use of reactors poses an important problem of shield optimalization. The convenient methods for solving this problem are still being sought for. One of such methods is the introduction of the function "effectiveness of the shielding material versus specific process". The mathematical methods of treating this function, particularly, the methods of the perturbation theory make it possible to find the conditions for the optimal composition of the shielding.